

# Environment Protection of Reserved areas – A Study of Gulf of Mannar (GOM) Biosphere Reserve

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**Abstract -** Protected areas in India comprise of Sanctuaries, National parks and Biosphere Reserves. The program of Biosphere Reserve was initiated under "The man and Biosphere (MAB) "program by UNESCO in 1971. Biosphere Reserves are areas of terrestrial and coastal or marine ecosystem, or a combination thereof, which are internationally recognized for promoting and demonstrating a balanced relationship between people and nature. This paper focuses on environmental planning of Gulf of Mannar Biosphere Reserve which extends from Rameswaram Island to Tuticorin with 130 species of corals. The study provides guideline for sustainable use of resources, activities to be permitted along coastal stretch, coastal highways, and mangroves, reclamation of saline and alkaline soil, coastal pollution, sedimentation, avifauna, settlements, tourism and recommended vegetation. It also provides guideline for the improvement of the relation between people and their environment globally.

**Key Words:** Eco system, Bio diversity, Corals, Mangroves, Flora, Fauna, Avifauna.

## I. INTRODUCTION

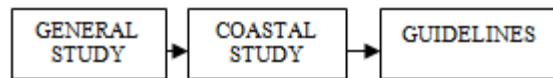
The coastal environment is very dynamic with many cyclic and random processes owing to a variety of resources and habitats. Further the coastal ecosystems are one of the most productive ecosystems on earth. About 60 percent of the world population lives near the coast and in one way or other depends directly or indirectly on the coastal zone and its resources. Thus the coastal zone plays a vital role on the nation's economy. As a result of increasing human population and the trend for a greater proportion of people to live close to the sea, the economic activities on coastal environment are also increasing. Hence there is an urgent need to protect the coastal environment and ensure its sustainable production and development. In India, Gulf of Mannar Marine Biosphere Reserve (GOMMBR) is a unique biosphere reserve in many respects (Fig 1). GOMMBR covers an area of 10,500 sq. km and includes 21 islands of varying area ranging from 0.25 ha to 129.04 ha. Factors like urbanization, population growth, industrial development, international trade, inadequate legislation, linear approach in resource utilization, tourism leading to habitat degradation, over-exploitation of resources are the known threats to the survival of unique life support system of the Gulf of Mannar Biosphere Reserve.

### A. Objectives of the Study.

This study was to obtain zones of suitability for preservation, conservation and development, Identifying the areas of immediate action along the coastal stretch,

Segregating the zones and the activities allowable and framing guidelines for sustainable usage of the coastal marine resources, recommend vegetation along this coastal stretch, coastal pollution, sedimentation, settlement, coastal erosion.

## II. FRAMEWORK OF THE STUDY



### A. General Study.

General Study includes Protected Area Network, Biosphere Reserves – Function, Biosphere Reserves –Zoning and Coastal Marine Ecosystem. The protected area network in India comprise of 15 Biosphere Reserves, 96 National Parks, 551 animal Sanctuaries. The Zoning of Biosphere Reserve consist of Core Zone which is a Strictly prohibited area, conservation and monitoring are functions allowed. Buffer Zone is a strictly delineated area, the allowable functions are research, education and tourism, activities are managed to protect the core zone. The Transition Area is the Outer area of the buffer zone; functions allowable are human settlements, research station, traditional use, education, training, tourism, recreation rehabilitation, facilities for research. Coral reefs are a distinctive shoreline habitat of stunning visual appeal found only between latitudes 30°N and 30°S. They grow only where sea surface temperatures are above 20°C. Most living coral communities do not grow at depths of more than 50m although some grow at depths of 100m. They are considered the most productive marine ecosystem, supporting as many as 3,000 species. Coral reefs form the most dynamic ecosystem providing shelter and nourishment to thousands of marine flora and fauna. Importance of Coral reefs is that they act as a bulwark against sea erosion, cyclone and protect houses, beaches and other coastal installation from tidal waves. Coral reefs provide an ideal habitat and feeding ground for various marine animals. Coral reefs absorb CO<sub>2</sub> and convert it to CaCO<sub>3</sub> and reduce the CO<sub>2</sub> in the atmosphere. Mangroves are termed as tropical tidal wetlands with typical vegetations distributed along the border of the sea and lagoons reaching upon the edges of the rivers to the point where the water is saline and growing in swampy soils covered by the saline water during high tides. They are salt tolerant forest ecosystem found in the inner tidal regions. The major threats for mangroves are hyper salinity, siltation, tree felling for timber and firewood, human inhabitation and pollution, embankment construction,

aquaculture, grazing by cattle/goat, overexploitation of juvenile fishes, disease, natural calamities (cyclone, storm and flood). The factors that influence mangroves are temperature, tides, salinity, rainfall and winds. Mangroves are under pressure due to salt pan conversions, development of ports, aquaculture, increase in population, dumping of industrial waste and their effluents leading to loss of mangrove ecosystem. Sea shells are the marine living organisms which belong to the family called Mollusca. Commercially many ornamental items are made from these shells. Collection, possession and trading of these marine living organisms and their products are happening in this coastal stretch. Seaweeds are marine algae. They occur in the inter-tidal and sub-tidal regions of the sea. They are very important marine living resources. They are the only source for the production of photo chemicals which are used in food industry, textile industry, paint industry etc. Over exploitation of seaweeds indirectly affects the coral reef ecosystem, as a result of increasing siltation in sea water. Seaweeds act as a protective barrier against the wave action. Reduction in seaweeds leads to coastal erosion and removal of coral reefs.

### *B. Coastal Study.*

The Coastal Study includes GOM – As a Biosphere, Physical Study, Islands, CRZ Classification, Geology & Geo-Morphology, Coastal Morphology, Vegetation, Coastal Highways, Visual Quality, Coral Reefs, Physical Features, Overlays, Overlay Inference, Zones Of Suitability. GOM is bounded by Palk Bay and Rameswaram Island in the north, Ramanathapuram district in the North West and west, Tuticorin district in south and Bay of Bengal in the east.



Fig. 1 Map of Gulf of Mannar Biosphere reserve

The climate is tropical and it comes under the spell of both southwest and northeast monsoons. Rainfall is moderate to heavy during October to mid- December under the spell of northeast monsoon. The mean annual rainfall varies from 762 mm to 1270 mm. The wind direction is north-northeasterly from June to December and changes to westerly during the rest of the period. The soil is typically coastal sand. Alluvial and beach sand cover most of the areas. The drainage system in the coastal part of Gulf of Mannar consists of Vaigai, Kappalar, Kottakkarai, Gundar, Vembar, Vaippar and Kallar and its tributaries. The trend of the rivers is from northwest to southeast. Vaigai and Vaippar are the biggest rivers in the Gulf of Mannar. There are 21 islands (Fig 2) lying off the

coast in Ramanathapuram and Tuticorin districts fig 2. Most of the islands are of coral origin. The 21 islands have an area of 623 hectares. Kurusadi Island is generally called as biologist's paradise, because of the richness of variety of fauna and flora. There is lush growth of mangrove vegetation with different species. Extensive coral reefs are present here. Large number of sea birds visits these islands. Dense coconut, acacia, Palmyra trees are found here. Commercial exploitation of seaweeds is done here. Illegal mining of coral reefs are done here. Coastal erosion is found on most of the islands. CRZ - 1: Most of the coastal stretch in this area comes under this zone – Pamban coast, Kilakarai coast etc CRZ – 11: Substantially developed coast - Tirrakkarai coast, Sayalkudi coast etc. CRZ -111: Remaining coastal areas come under this zone. Coastal Highways are NH – 49 (Madurai to Rameswaram) ,ECR – phase 11 (Cuddalore to Tuticorin). At Keelakarai the proposed ECR comes very closer to the HTL. At Pamban the highway is very close to the shoreline. This will affect the coastal marine resources.

Preservation zone are of a landscape character deserving complete preservation as a nature preserving. People depending on this zone should be educated so that they won't disturb corals, mangroves.



Fig. 2 Gulf. of Mannar Coastal Morphology

Conservation zone are less sensitive or less productive areas are suited to limited use. Natural features will be conserved and protected in and around these areas with movement of pathways taken care of to bring people and nature into compatible relationship. Development zone are the natural landform and vegetation are of minimal significance. Facilities for ecotourism should be developed only in this zone.

### III. GUIDELINES

#### *A. Guidelines for sustainable resources management.*

Periodical monitoring and research of presence of the coral reefs has to be done to distinguish the growth of the coral reef. Biologist's paradise "Kurusadi Island" comes under core zone. (Fig 3) Coral mining is strictly prohibited here. Dumping of solid waste near Mandapam fishing village has to be stopped. Traditional fishing is allowed in buffer and

transition zones. Commercial fishing is to be banned. Sea route for tourism or trade should be obtained by careful monitoring



Fig. 3 Gulf of Mannar Coral reefs near Kurusadi Island

#### B. Guidelines for coastal highways.

At Pamban, Causuarina is to be planted on either side of ECR which acts as wind breakers (Fig. 4)

#### C. Guideline for mangrove.

Conversion of mangroves into salt pans should be stopped. In some areas restoration is possible. Here the soil has to be treated to reduce the salinity and then plantation of mangroves species is to be done. Fire wood collection in Kurusadi is to be banned. To protect the islands, re-vegetation of mangrove species has to be done.

#### D. Guidelines for reclamation of saline-alkali soils.

Salinity tolerant and alkali tolerant plants can be grown without any reclamation. The soil conditions can be improved so that the salt content is reduced.

#### E. Guidelines for coastal pollution.

The industrial effluents of Tuticorin alkali chemical, SPIC Ltd – Tuticorin, DCW Ltd – Tuticorin, Thermal power station; before it gets mixed with the River Vaiper, River Vembar and River Kallar should be treated properly (Fig. 5). No new industrial development on the eastern side of Tuticorin. Industrial growth is allowable on the southern side of Tuticorin. No further new industrial development on the seaward side near Tuticorin should be allowed.

#### F. Guidelines for Sedimentation.

In Tuticorin and Mandapam coastal areas the cyanide poisoning method of fishing is to be banned. Traditional fishing methods should be encouraged in all the coastal villages of Gulf of Mannar. Commercial fishing methods should be totally banned in the core and the buffer zones. Conversion of mangroves and marsh vegetation into salt pan in Tuticorin and in Valinokkam should be stopped and this can be allowed south of Tuticorin. Over fishing in Mandapam region should be controlled. All the industrial effluents should be treated properly before it gets mixed with River Vembar and River Vaiper.

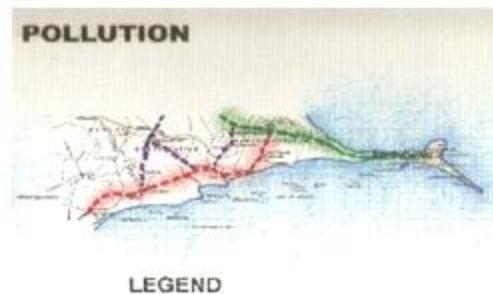
#### G. Guidelines for Settlements.

At Pamban region, the huts are very close (within 25m) to the high tide line. These settlements are to be relocated

towards the south of Mandapam fishing



Fig. 4 Coastal highway



LEGEND

NATIONAL HIGHWAY 49

Fig. 5 Coastal pollution

village. At Kilakkrai region, the drainage from encroachment settlements gets mixed with seawater and this will affect the coral reef (Fig. 6). Proper settlements can be provided for these encroachments in the southern side of Kilakkrai region.

#### H. Guidelines for Avifauna.

To improve the bird habitats in Manoli and Appa islands, tree species like Barrington, Acacia, and Pongamia should be grown. For revegetation of mangrove, species like *Avicenia marina*, *Lumnitzera racemosa* are to be planted in these islands.

#### I. Guideline for Coastal erosion.

Protective measures are taken either by structural works or afforestation. Casuarina should be grown to control wind erosion.

#### J. Guidelines for Tourism

The environmental movement has intensified the relationship between nature and tourism resulting in a form of nature tourism with an ecological bias called as the eco-tourism. Framing requirements for creating awareness about this biosphere reserve are Glass bottomed boat club, Nature trail or beach teach walk, View towers, Research trips, Field study centre in Kurusadai island, Interpretive centre on the GOM and its biodiversity, Oceanarium, Aquarium, Museum, Scuba diving school, Snorkelling, Bird watching, Eco beach resort (Fig. 11)etc.



Fig. 6 Settlements

### K. Guidelines for Recommended vegetation.

Recommended road side plantation are Albizzia lebbek, Azadirachta indica, Spathodea campanulata, Peltophorum, Samanea Saman, Terminalia arjuna, Pongamia glabra, Thespesia populnea, Kigelia Pinnata, Alstonia Scholaris, Tectona Grandis, Terminalia catappa, Parkia biglandulosa. Recommended vegetation for highly saline soil (Tuticorin region) are Azadirachta indica, Pongamia glabra, Atriplex ripens, Dalbergia sissoo, Casuarina equisetifolia, Butea monosperma.

### L. Overlays.

The overlays are given in (Fig.7,8,9,10)



Fig. 7 Overlay with respect to mangroves



Fig. 8 Overlay with respect to Coral reefs



Fig. 9 Overlay with respect to Shell areas.

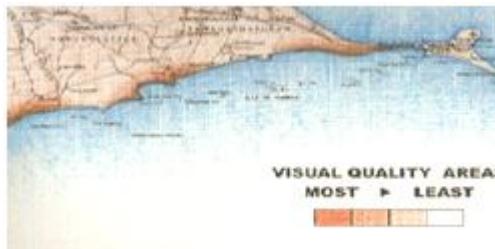


Fig. 10 Overlay with respect to Visual quality.



Fig. 11 Ecotourism.

Areas of immediate action is shown in Fig. 12. The zones of suitability are shown in Fig. 13.

### CONCLUSION

The study helped to obtain zones of suitability for preservation, conservation and development and areas of immediate action. It also leads to framing requirements that will create awareness and educate public about the coastal marine ecosystem. The guidelines help to conserve the unique Gulf of Mannar marine biosphere reserve and also help for sustainable usage of marine resources.

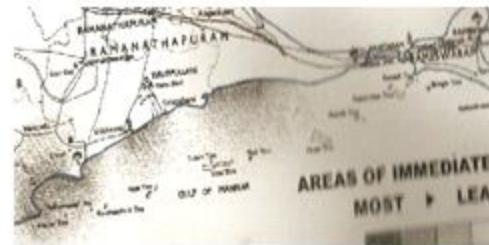


Fig. 12 Areas of immediate action.

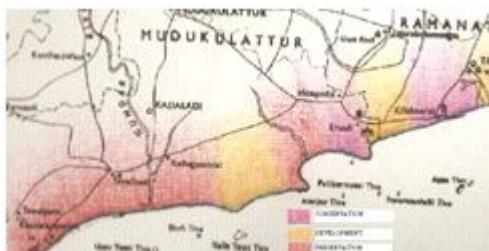


Fig. 13 Zones of suitability.

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